

Several projects at INL's Center for Space Nuclear Research focus on Nuclear Thermal Rockets (NTR). CSNR's summer fellows do feasibility assessments of advanced technologies that could be applied to space exploration.

## Center for Space Nuclear Research students tackle tough problems

by [Jo Seely](#), *Nuclear Science and Technology communications intern*

Questions about energy in our universe, and maybe even the fate of the planet, consume the minds of 15 unique summer school students at [Idaho National Laboratory](#).

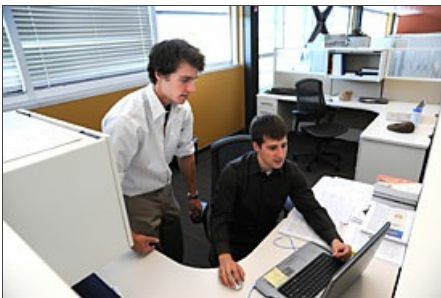
Deflecting comets that threaten Earth is just one of the projects students within the [Center for Space Nuclear Research Summer Fellowship Program](#) will tackle for INL and [NASA](#). The fellows come from different fields and universities around the country, but all were attracted to the program by the cutting-edge research within space nuclear power and propulsion.

Their projects are typically feasibility assessments of advanced technologies that could be applied to space exploration. The projects are conceptual, allowing the students to learn about issues involved in the technology, such as materials properties, system balances, thermodynamics and reactor physics.

"The CSNR and INL benefit from the technical assessment of the ideas performed," said Steve Howe, Ph.D., director of CSNR. "These assessments are then used to write proposals for future research that could lead to new, innovative technologies for exploration."



*The CSNR Summer Fellowship Program began in 2006, allowing students the opportunity to study theoretical problems of energy in space.*



**CSNR Summer Fellows Logan Sailer, left, and Jeff Katalenich, right, work to solve theoretical problems involving the NTR-Tug.**

Erick Ball, an undergraduate student studying physics at Swarthmore College, works on the five-person team evaluating expected performance of the Nuclear Thermal Rocket (NTR) that could intercept a comet bound for Earth.

"The project is fascinating to me because it's on such a different scale than previous efforts," said Ball, a senior from Seattle. "Most information available about [comet] interception deals with small, slow-moving objects and long warning times, but with the NTR we're able to tackle very near the worst-case scenario: a 10-kilometer (6.2-mile) comet going 60 kilometers per second (134,280 mph) with only four months warning."

Ball said he had been interested in nuclear engineering and the space program for the past couple years. Like many of the other fellows, he is using his experience at CSNR to help choose a career path while gaining practical experience from INL scientists.

Jeff Katalenich is in his third summer at CSNR. He works with Ball on the NTR Tug project, studying the use of a rocket to maneuver satellites between low and high orbits. Katalenich studied mechanical engineering during his undergraduate training, but said after his experience at CSNR, he decided to continue with a master's degree in nuclear engineering.

"CSNR was the chance to do something really cool," said Katalenich, who will begin at University of Michigan this fall. "I was doing something applicable, and it became the step toward research and graduate school."

Through the 10-week session, students get experience forming their own research projects, setting a schedule and establishing milestones. In the end, the students gain writing and speaking experience through presenting their findings to the group.

"We collect top quality students from around the country and place them on a path to become a part of the INL," said Howe. "We want students to recognize INL and Idaho Falls as a place for

### Past and Present Projects of the CSNR Summer Fellowship Program

- Investigating potential benefits of using a nuclear rocket to support a Lunar Outpost.
- Designing a mobile Fission Surface Power reactor for the lunar surface.
- Fabricating refractory nuclear fuels, specifically fuels encapsulated in a protective tungsten shell, examining the issues associated with alternative radioisotopes, advanced power conversion

advanced research."

Logan Sailer said he always had "the lab influence" because he was raised in Idaho Falls, INL's hometown. He studied aeronautical engineering at [Florida Institute of Technology](#) but returned to Idaho Falls the past three summers to take part in the projects at CSNR.

"What we're doing every summer is really applicable to the NASA and [Department of Energy] scene," said Sailer, who will begin a master's program at University of Washington this fall. "While I am continuing with rockets, I realize there is a need for more application of nuclear science in space."



***A theoretical nuclear rocket that deflects comets threatening earth is one project of CSNR Fellow Erick Ball.***

Howe said the program allows for students around the country to become aware of the presence of nuclear applications in space. As for the CSNR students, he said, "We want them to come away with a general understanding of nuclear issues in space activities."

This summer there are five different projects, from lunar surface reactors to lunar "super light bulbs." All students have a role in two projects where their interests and backgrounds apply.

"In the groups I'm working with, there's very little in the way of definite requirements for how to solve the problems or even definitions of what problem needs solving," said Ball. "We are free to take whatever approach we believe will be most effective."

For more information on the CSNR Fellowship Program, visit <http://csnr.usra.edu>.

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methods and alternative production mechanisms.

- Developing concepts for radioisotope-powered unmanned aerial vehicles and unmanned underwater vehicles.
- Reducing the mass and complexity of surface power reactors by using water as a radiation shield.
- Evaluating an NTR that will intercept a 10- km comet going 60 km/s from Jupiter given only four months warning.
- Developing an NTR Tug to maneuver satellites between low and high orbits.
- Assessing the feasibility of an advanced optically coupled reactor for a lunar base, a "super light bulb" used to reflect light 1 to 2 kilometers back to the base.